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JOHN W. FINCH, DIRECTOR

INFORMATION CIRCULAR

SOME SUGGESTIONS ON SAFETY IN COAL-MINE HAULAGE

BY

C. A. HERBERT

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SOME SUGGESTIONS ON SAFETY IN COAL-MINE HAULAGE[1]

By C. A. Herbert[2]

INTRODUCTION

Haulage accidents usually are responsible for about 17 or 18 percent of all coal-mine fatalities and about 21 percent of all nonfatal coal-mine accidents. When the relatively small number of employees continuously exposed to haulage hazards is considered, it would appear that haulage is more hazardous than any other phase of coal-mine operation.

Haulage accidents have increased from year to year, doubtless due to the increase in electrical haulage, and particularly to the use of larger cars, heavier locomotives, longer hauls, and greater speed. Unless very definite steps are taken to eliminate the causes of these accidents, they will continue to increase rather than be reduced, as they can and should be.

Underground haulage in many of the large modern mines of today is similar in many respects to railroad practice. In recent years the railroads have made wonderful strides in reducing accidents, and instead of being one of the most hazardous occupations, as it once was, railroading is now one of the safest. Doubtless, if thought and action, similar to that given to reducing accidents among railroad passengers and employees, were given to safety in mine haulage, underground haulage accidents could be reduced in about the same ratio.

Haulage accidents may be classified, according to responsibility, into two groups - those for which management is largely responsible and those for which the employee is largely to blame; there is, however, an overlapping of responsibility from one group to the other. If, therefore, haulage accidents are to be reduced, it is absolutely essential that both management and employees cooperate to this end.

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[1] The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6969."

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In the first group, for which management is largely responsible, may be included accidents due to faulty equipment, poor track, a poorly arranged system of haulage, lack of clearance or of overhead protection, and dirty roadways; even in these features, however, the employee is not without a measure of responsibility, as failure of haulage equipment possibly may be due to lack of care on his part, failure to report when equipment is out of order, or failure to do a good workmanlike job of installing or repairing or operating.

To the second group of accidents for which the employee may be largely responsible, belong those caused by such careless practices as jumping on and off fast-moving trips, coupling on the "fly", running at excessive speeds, failure to properly block cars, and similar hazardous and unnecessary acts of omission or commission. If, however, management condones such practices, or, as in some instances, insists upon them, it must accept its share of responsibility for the accidents that inevitably result.

Some of the most prolific sources of haulage accidents will be discussed briefly, together with the steps that may be taken to minimize their occurrence.

MINE TRACK

Poor track is as inimical to efficient mine operation as it is to safe haulage. The track should be laid with rails and ties large enough to withstand the weight of cars and locomotives operating at reasonable speed, otherwise it will be impossible to keep the track in a safe and efficient operating condition. Where wood ties are used it usually will be found more economical, especially on main haulage roads, to use treated ties if the expected life of the track exceeds 2 years. The track should be ballasted properly and the road bed adequately drained. Crushed stone or gravel is an ideal material for ballasting on permanent haulageways; although the first cost may be high, the ultimate benefit may fully justify such expenditure.

The curves of all turnouts should be of maximum radius consistent with surrounding conditions and, so far as possible, should be standardized. The frogs and switches used in connection with turnouts should be of standard make and laid according to a definite plan or system; if this were done there would be much less cutting and fitting (some of it involving hazardous work) for the tracklayer to do, and at the same time a much better job would be obtained.

Frogs and switch assemblies of standard manufacture usually are far more satisfactory and in the long run more economical than those made in the company's shop.

All frogs and switches should be blocked to prevent employees from getting their feet caught in them, with the possibility of being run over before the motorman can stop his trip.

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All switches should be equipped with switch stands or throws, particularly in mines where haulage is mechanical. Loose switch points or latches that are kicked into position by the haulage crew while on moving cars or locomotives have caused many accidents and should not be used if safety is being considered. There is nothing to hold these loose latches in position and they often spring open as the wheels pass over them, causing derailments and wrecks, with consequent accidents to workers as well as delay in work and breakage of equipment. In attempting to prevent these untoward occurrences, haulage employees often are observed to reach between each succeeding car in the trip and to pull the latches over by hand, a practice that has resulted in many severe hand injuries as well as in occasional fatalities. This practice could be avoided, where loose latches are used, by extending the bridle bar out beyond the track with the end turned up to serve as a handle by which the latch could be held in place without reaching between the car wheels. Use of loose latches is not good safety practice under any condition.

The switch stand or throw should be set as far back from the rail as possible, preferrably in a recess cut in the rib. All stumbling hazards at the switch stands or throws should be eliminated.

TRACK LAYOUT

Much could be done to avoid haulage accidents by giving more thought to the track layout, both on the inside and at the shaft bottom or main parting, to eliminate as far as possible the necessity of making flying switches or of pushing loaded or empty trips.

CLEARANCE

Large percentages of fatal and nonfatal injuries chargeable to haulage are due to lack of proper clearance between cars on parallel tracks, or between cars and locomotives and rib or roadside posts or timbers; faulty conditions with regard to overhead clearance also cause many haulage accidents, some of them fatal.

Where natural conditions permit, it is desirable to drive haulage entries wide enough to allow ample clearance on both sides of the track. Where this is not possible (and very often it is not possible), a continuous clearance or wide side should be maintained along one side, and where trolley haulage is utilized, the side opposite the trolley wire should be given clearance. Obviously, it is impossible to lay straight track and at the same time maintain a uniform clearance on one side unless the entries are driven straight, using the surveyors sight lines, and the ribs kept at a uniform distance from the entry sight lines and parallel to them; to do this requires the close attention of the foreman and the earnest cooperation of the cutting-machine crews and those entrusted with the blasting.

A minimum allowable clearance also should be established and rigidly enforced for the setting of all roadside timber in rooms and on entries.

On haulage entries it is much safer, also, to recess the legs of all timber sets into hitchings cut in the ribs or, where it is possible and the coal is strong enough to hitch the ends of the collars into the ribs, to do away with the legs entirely; this latter method has been facilitated by the use of hitch-cutting drills now on the market.

Numerous accidents resulting in fatal and serious nonfatal injuries have occurred because of failure to allow enough clearance when placing cars on sidings and turn-outs along haulage roads. To assist haulage crews to know when the proper clearance has been left between the car and the main-line track, a light might be used or a marker placed on the roof or track to indicate the point of minimum allowable clearance between the equipment on the siding or turnout and the straight track. This practice has been followed on railroads for a number of years and might well be adopted in connection with underground haulage.

Proper overhead clearance also is essential for safety, but frequently it is difficult of attainment. Where crossbars or sections of the haulage roads are so low that the loaded cars rub the crossbars or the roof, wrecks and spilled coal result; and in many instances workers are caught between cars or locomotives and overhead material with resultant serious or fatal accident. The coal knocked off the cars adds to stumbling hazards and also is ground by the car wheels, which adds to the explosion hazard; many wrecks and derailments, with their accompanying accidents, are caused by dirty trash.

Abrupt changes in overhead clearance are dangerous and should be eliminated wherever possible. When it is not possible to eliminate them, they should be marked distinctly by lights, whitewashing, reflector buttons, or otherwise, to call attention of the haulage crew to them. Railroads have recognized this hazard for many years and have guarded against it by suspending small knotted ropes over the track (tell tales), which strike the train men and warn them of the approaching hazard, should they be standing on the cars.

Low and unguarded trolley wires are an ever-present hazard to haulage crews. They should be guarded, at least at all switches or other points where they cross over the haulage road, and preferably they should be guarded their entire length, especially if the haulage entries are low and it is impossible to keep them at least 6 1/2 feet above the rail. Many fatalities on haulage tracks that are charged to haulage should really be laid to the unguarded trolley wire. The real solution of this phase of the haulage-accident problem is to substitute storage-battery or other type of haulage for the trolley system.

Most certainly in mines where the coal is low and it is difficult to maintain adequate clearance between the trolley-wire and the rail or to maintain trolley-wire guards, most careful consideration should be given to the use of a storage battery or other type of mine locomotive and thus eliminate the trolley wire.

LOOSE AND IMPROPER CLOTHING

Since hard hats and safety-toed shoes were adopted, many injuries in connection with haulage operations have been prevented; the use of such protective equipment should be mandatory.

The wearing of loose or torn clothing should be prohibited, also. Jackets or jumpers should be worn inside overalls, and trouser legs either should be tied around the ankles or worn inside the socks or boots. Jacket sleeves and gloves should fit the wrists snugly.

SHELTER OR REFUGE HOLES

The mining laws of most coal-producing States require that shelter or refuge holes be maintained at stated intervals along haulage roads. If at all feasible, they should be located on the wide or clearance side of the roadway opposite the trolley wire; where this is not possible, the trolley wire or other power wires should be guarded properly in front of these shelter holes. The holes should be maintained free of refuse, should not be used as storage places for materials, and should be marked plainly, preferably by an electric light.

STUMBLING HAZARDS

Each year employees engaged in haulage, as well as other underground employees, are injured because of stumbling hazards along haulage roads; this is true particularly of drivers, who are obliged to run alongside moving cars to sprag them.

Refuse materials, rock, or road dirt should not be allowed to accumulate along the sides or roadways. Where it is necessary to place temporarily timber, ties, rails, or refuse material along the sides, these should be placed close to the rib so as not to form stumbling hazards along the walkway or clearance side of the roadways and, as soon as possible, most temporarily stored material should be removed from the haulageway and all waste material, coal, dirt, etc., should be loaded out. It is the practice at many mines, where possible, to load the waste material and rock into cars at the time the timbering or track work is done, instead of throwing it along the side of the roadways to be handled subsequently; this effects considerable economy, as only one handling of the material is necessary and, in addition, many hazards to the mine and its workers are thus removed.

ILLUMINATION

Proper illumination aids greatly in preventing all types of accidents in mines, particularly haulage accidents. As a minimum requirement, all shaft bottoms, partings, and switches or turnouts from the main haulage roads should be well lighted. In addition, it is desirable to have lights in front of each shelter hole along the haulage roads; this would give ample illumination to enable a person to make his way along the roadway unaided by his

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portable light, which would be a distinct advantage in the event of its failure. In addition, a well illuminated roadway makes it possible to discover dangerous conditions in time to avoid an accident.

In addition to offering protection against the propagation of coal-dust explosions, rock-dusting greatly increases the effectiveness of whatever lighting is furnished, because far less light is absorbed by the white, rock-dusted surfaces than by the coal ribs and dark roof.

Haulage crews and fire bosses, face bosses, and others responsible for locating and handling dangerous conditions in mines should be furnished with electric cap lamps even though the mine otherwise may be operated with open lights. The failure of a driver's or triprider's open light just at a moment when he needs it most in far too many instances has resulted in his injury, and many electrocutions of haulage men by the trolley wire have occurred when their open lights failed or when something happened to the contact between the trolley wheel and the wire. Where mule haulage is used and electric battery lamps are hung on the harness to give the mule light enough to prevent its stumbling and falling, there is a possibility of avoiding serious injury to both driver and mule.

The use of reflector buttons on the end of trips and in numerous other ways on haulage roads or equipment should be at least as effective in mines as on our streets and highways.

HAULAGE EQUIPMENT

Poorly designed and inadequately or poorly maintained haulage equipment is both inefficient and hazardous.

Mine cars are often poorly designed and poorly constructed for the service expected of them. Often the bodies of the cars are too long for their wheelbase, which causes the cars to rock up and down when the track is uneven. In other cases, the wheelbase may be too long for the short-radius curves they are expected to negotiate. In both instances unnecessary derailments occur. Cars often have inadequate bumpers, which fail to give safe clearance for coupling between the bodies of the cars and cause the corners of the cars to bind when they are pushed around curves, which causes derailments and consequent accidents to workers.

Open hook hitchings or couplings are still used in some mines and are dangerous from the fact that they are likely to become uncoupled when the cars bump together. The type of coupling used should connect the cars securely and at the same time be easy to operate. In mechanically operated mines where large cars are used, automatic or semiautomatic couplers have been adopted with marked success.

At some mines where the link and pin or clevis and pin type of coupling is used and it is necessary to uncouple the cars to cage or to dump them, the men whose job it is to do the uncoupling are furnished with steel hooks with which they can pull out the coupling pins without reaching between the

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cars to uncouple them with their hands; this is a practice that should be followed much more widely than it is now.

It is desirable to have brakes on cars in either mechanical or animal haulage. Where animal haulage is used and, particularly, where grades are encountered, the cars most certainly should be equipped with brakes; they will permit the driver to ride the rear bumper and at the same time to control the car and keep it from running up onto the mule; also, they will obviate, to a large extent, the necessity for jumping on and off moving cars to set and take out sprags.

Where cars are not equipped with brakes and the driver rides the front end of the car, with one hand on the mule to hold the car back, or slides the rail with his feet as a brake, and, in addition, is obliged to jump on and off the front end of the moving car to set or remove sprags, it is little short of a miracle that the accident rate among drivers, even though exceedingly high, is not much higher than it is.

Where sprags are necessary, they should be neither too short not too long. If they are too short, the employee's fingers may be caught, and if they are too long, someone along the side of the road may be caught by them or they may strike an obstruction and cause a derailment. The best type of sprag is provided with a guard to protect the hand while the sprag is being placed.

At many mines, the use of sprags to control cars on partings, at shaft bottom, or in tipples has been discontinued in favor of slider or "scotch" blocks. In fact, with many of the newer types of large cars now in use in mechanically operated mines it is almost impossible to use sprags safely.

In locomotive haulage, many serious and fatal accidents have been caused in wrecks by the car next to the locomotive riding up into the cab and crushing the motorman, due to a faulty coupling device between the first car and the locomotive. The type of coupling or connection used between the first car and the locomotive should preclude such an occurrence as far as possible; and it would be well to alter the design of the locomotive "cab" so it would be very difficult, if not impossible, for the car next to the locomotive to ride or rise into this cab.

When cars are hauled up long grades by rope or locomotive, the last car should be equipped with a drag to prevent the cars from running back should a coupling or hitching or the rope break. Also, when it is necessary to handle cars on a steep incline from the mine to the tipple, or in pitching seams, where the main haulage is by slope, the cars also should be equipped with safety chains, which should be connected while the cars are in transit, either on the incline or on the slope.

BLOCKING CARS AT THE FACE

Failure to block cars properly at the face has resulted in many injuries and fatalities, particularly where the place is either going to the dip or to the rise. Derail switches, automatic or otherwise, should be installed in steep inclines. Simply putting a cap board or piece of rock or coal under the wheels, or spragging them with a piece of stick, is not sufficient. The car either should be blocked securely by ties or other suitable timber - one timber being placed across the track and the other under the end of the car and on top of the cross timber - or the car should be secured by a chain and clevis, the chain passing through one of the wheels and under the track, or by some other suitable device that is positive in action.

When the car wheels are insecurely blocked or spragged on a grade, the weight of the car, after it is loaded, may cause the wheels to cut through this material, allowing the car to run either towards the face, with the possibility of crushing the miner if the place is dipping, or out onto the entry, with the possibility of either running over someone or running into an incoming trip if the place is going to the rise; where the track is level, there is always the possibility that the car may be hit by a moving car or by the locomotive, with disastrous results to any one unfortunate enough to be between the car and the face.

SIGNAL SYSTEMS AND CONTROL OF HAULAGE

In small mines where animal haulage is used entirely, the boss driver or parting boss, with the aid of the mine telephone and the assistance of the trappers, usually can control haulage operations satisfactorily, but even in such mines grades often are steep at branch roads, and manually operated signal lights to indicate whether the main line is clear could be used to advantage.

In larger mines where haulage is partly or wholly mechanical, a block-signal system should be used. This may be entirely automatic or partly automatic and partly manually operated, as the needs indicate. In some of the larger mines all haulage operations are in charge of a dispatcher who controls the movement of all trips in much the same way that a railroad train dispatcher controls the movement of all trains.

At many mines, main-line switch stands or throws are equipped with lights to indicate whether the switch is open or closed, and in some instances these show a red light if the switch points are open as little as one-half inch, due to coal or refuse getting in between the point and the rail. Thus, wrecks that sometimes result from split switches are prevented.

Electrically operated switches on main-line haulage roads have proved to be both practical and efficient. With their use, the motorman is able to throw the switch to a turnout or side road while still some distance from the switch, thus obviating the necessity of stopping or slowing up to any extent. This is a decided advantage where heavy trains are handled. Where such switches are used, it is necessary that the switch be equipped with lights to indicate whether it is open or closed, and also should have the point of control remote enough to enable the motorman to stop the trip should the electrically operated switch fail to function.

Excessive haulage speed frequently causes wrecks, with resulting property damage and severe or fatal injuries. Locomotive speed should be governed by the conditions under which the locomotive is operated, but speed in excess of 6 miles an hour seldom is necessary. Much higher velocity is allowable on main haulage inclines and in shafts, but here, also, excessive speed is hazardous to both life and property essentially as excessive speed is responsible for many accidents on streets and highways.

Allowing locomotives or locomotive trips to follow one another at too short intervals also has resulted in numerous accidents. A definite minimum allowable distance between following locomotives or locomotive trips should be established and enforced. This distance will vary somewhat, depending upon local conditions. Racing of locomotives coming out of the mine at the end of the shift has resulted in many bad accidents.

Overloading locomotives is not only detrimental to the equipment and to the efficiency of operations, but also may result in accidents. The maximum number of loaded cars that each locomotive can handle on its particular run should be established and the number held strictly within this maximum, as many very destructive accidents have been caused by handling more cars than an established maximum number when some so-called emergency arose. In no case should a motorman attempt to handle more cars than he can control and no more than he can pull without jerking. Jerking loads or empties causes far more strain on the couplings than straight pulling and frequently causes couplings to break, with the resultant hazard of broken trips and lost or runaway cars; jerking also is a fruitful cause of thrown lumps of coal on the haulage floor, entailing numerous other hazards.

The rear end of all motor trips should be supplied with a marker, preferably a red light, that can be seen by the motorman and also from the rear. With such a marker the motorman, by glancing back over his trip, can see whether his marker is burning, and if it is not he can determine the cause at once. If it is because a car is lost he can take the necessary steps to recover it or to report its loss and in this way may avoid an accident. When a trip arrives at the bottom or the main parting or at the inside parting without the marker, a count of the cars will disclose at once whether the marker only has been lost or whether one or more cars have been lost as well; in the latter case, the necessary steps can be taken to warn those in charge of succeeding trips. The marker on the rear of a trip also aids persons walking on the track in preventing runaway cars or trips from hitting them when they cannot hear the oncoming car or cars because of noise from some other source.

All cars left standing should have their brakes set, if they are equipped with brakes; if not, they should be blocked or spragged, as grades are often deceptive; places that appear to be level may be on a steep enough grade to cause the cars to start rolling.

Rerailing cars or locomotives often results in serious injuries when proper precautions are not taken. A well designed rerailer and a suitable

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jack should be regular equipment on every locomotive. When it is necessary to use ties or other blocking, in no instance should the blocking be held in place by the hands or feet while the derailed car is being moved. In addition, those engaged in the rerailing work should stand in the clear while the cars are being moved so that there may be no danger of getting caught by the car or by the material used as blocking. The greatest care should be exercised when rerailing a locomotive or a car to prevent contact with the trolley wire, as many persons have been killed by contacting the trolley wire in rerailing cars and locomotives.

When materials such as rails, ties, and timber are handled there should always be one or more empty cars between the material cars and the locomotive to prevent the motorman from being caught by the shifting material in the event of a wreck or of sudden stopping of the trip.

MANWAYS AND MAN TRIPS

Many underground employees other than those employed in connection with haulage have been involved in haulage accidents. Often haulage roads are the only available roadways on which men can walk while going from one part of the mine to another and, although the men employed at the face may be hauled to and from work in man trips, there are always occasions when a certain amount of traveling by foot is necessary.

To avoid hazards to men walking along haulage roads, an entry should be driven parallel to the haulage road and maintained in easy and safe condition as a manway or walkway. Adequate warning devices should be provided where manways cross haulage track. Where feasible, it is desirable that the direction of the air current in the manway be the same as on the haulage road to avoid the necessity of doors at the points of access to the manway. Where manways are provided, walking along haulage roads should be prohibited.

In mines where men are hauled to and from the face workings in man trips, numerous serious and fatal accidents have occurred for lack of proper safety precautions.

If mine cars are large, with high sides, making it difficult to get in and out of them, it is desirable that specially built man cars be used, with an opening at each end, making it unnecessary to climb over the side.

It is also desirable that a special loading and unloading place be made available on the inside at one side of the main haulage road, where the man trips may be parked during the working shift and where they will be available to the men at quitting time; this will keep men from congregating on haulage roads while waiting for the man trips at the end of the shift.

At points where man trips are loaded or unloaded, the trolley wire should be guarded fully or there should be a cut-out switch in the trolley line and the electric current cut off the trolley wire while the men are loading and unloading.

Unless the trolley wire in the mine is guarded throughout its entire length, the men should be allowed to sit only on the side of the car opposite the wire.

Control should be maintained over the men while riding on the man trip and also while getting on and off the cars. Men have been injured while standing up in cars or attempting to get off before the trip came to a stop or by pushing and crowding while getting on and off.

Men should not be permitted to get into cars from the tight or trolley-wire side, to sit on the sides of the car, or to ride the bumper; they should be required to sit down inside the car and to keep their hands and arms inside.

Man trips should be operated at moderate speed and under absolute control at all times, and, where feasible, a mine official should accompany each man trip. Cars or locomotives following a man trip should be required to keep a safe distance apart.

On slope haulageways the safe operation of man trips unquestionably begins with the rope and the hoisting engine. The rope and connections should be adequate in size and conform to the rope manufacturer's standards. They should be inspected at frequent intervals and revewed when unduly worn. The hoisting-engine drum should have a flange wide enough to prevent the rope coming off the drum and should be equipped with brakes capable of stopping and holding the descending trip without the necessity of reversing the engine and applying power (plugging).

All slope mantrips should be provided with a safety rope extending from the lowermost car to a separate connection above the rope socket or rope clamps.

As a protection against the breaking of car couplings or the hoisting rope, a truck with suitable arresting devices that act with release of tension of the hoisting rope, should be coupled below the man cars. As in the case of man trips hauled by locomotives, it would be desirable if special cars were used for slope man trips and maintained for this purpose only.

No tools or explosives should be permitted in the man cars. When it is necessary for men to take tools into and out of the mine at the beginning and end of the shift, a separate tool car should be provided.

DANGEROUS PRACTICES

Many haulage accidents may be charged to dangerous practices of employees that are often "winked at" and, in some instances, required by the supervising officials with the mistaken idea that they are necessary to maintain maximum production. Accidents from such causes will continue to occur, irrespective of the haulage layout or how well the haulage equipment is designed and maintained, if the employees are permitted to continue unsound safety practices.

Jumping on and off Moving Trips

Jumping off a moving trip or locomotive and running ahead to throw a switch or open a trapdoor is dangerous, although very common practice; the practice is especially common and dangerous in slope haulage. Little time is saved and there is always the possibility that the person will stumble or miss his footing and be hurt or killed before the trip or locomotive can be stopped. The practice is not always confined to the triprider or others who may be riding on the locomotive; motormen, also, have been observed to jump off the locomotive of a moving trip while the power was still on to throw a switch or open a door and then to jump back on as the locomotive came past. Such practices by motormen are potentially much more hazardous than by triupriders or others and often men have been killed or very seriously injured in this way.

It is realized that when a heavy trip is stopped to open a trapdoor or throw a switch, especially where the grade is adverse, it is sometimes difficult to get it started, and there is the temptation for the haulage crew to take chances to avoid delays. In such instances an electrically operated door or switch with the controls a safe distance back along the entry will obviate the apparent need for this practice.

Operating Haulage Locomotives From Outside the Cab

Motormen have been observed to get off a moving locomotive in an attempt to open a sandpipe or to make some minor adjustment and also to handle the controller while walking alongside the locomotive; a misstep or stumble might result in severe injury to the motorman and possibly in a runaway trip, which would be hazardous to others, also. Another bad practice is to use the hands in trying to free clogged sand pipes while the locomotive is in motion.

Backpoling or Running With the Trolley Pole in the Reverse Position

"Backpoling" has been responsible for numerous accidents. If the trolley should jump off the wire while being operated in this position, it is possible that a timber may be knocked out or the motorman hit with the broken end of the pole; many persons have been killed by various occurrences connected with backpoling.

Kicking Switch Latches Over While Riding Moving Cars or Locomotives

Reaching down to kick over a latch while riding on the front end of a car or locomotive is an extremely dangerous procedure and should neither be allowed nor practiced. The man may get his foot caught or lose his balance and fall, and there is always the possibility that he may fail to get the latch over into the proper position and derail the car. Equipping the switches with switch throws would eliminate this practice.

Reaching Between Moving Cars to Hold Latches in Position

In mines where loose latches are used, the latches often work open as the cars pass over them; to keep them in the proper position and prevent derailments, tripriders or others reach between the cars and pull the latches over into position. This practice has resulted in needless loss of many fingers and hands which could have been prevented by the use of switch throws or by simply extending the bridle-bar out beyond the track with the end turned up as a handle, by which the latches could be held in position without exposing the fingers or hands.

Coupling and Uncoupling Moving Cars

Coupling and uncoupling moving cars, or "on the bump," as it is sometimes termed, has resulted in the loss of many fingers and hands as well as in more serious and fatal injuries. Little advantage in time or in tonnage is gained by this practice. It has been prohibited in many mines without decrease in tonnage hauled; in fact, in some mines an increase in tonnage hauled per locomotive has been shown after the practice was prohibited. The use of automatic or semiautomatic couplings on mine cars would tend to eliminate injuries from this source by removing to a large extent the necessity for reaching between cars to make the coupling.

Coupling And Uncoupling Cars From The Inner Side Of Curves

Some mine cars are so designed that there is little if any clearance between the corners of adjacent cars on the inner sides of curves; it is, therefore, very hazardous to attempt to couple or uncouple cars from the inner side of the curve as the workman runs the risk of being crushed between the corners of the cars should they be bumped together while he is reaching to couple or uncouple them. This practice is so obviously hazardous, as proven by the numerous very bad accidents which continue to occur from this cause, that it is difficult to understand why it continues to be used.

All coupling or uncoupling on curves should be done from the outer side of the curve.

Failure to Keep Switches to Rooms and Other Working Places Alined With the Straight Track

Many fatal and serious injuries have been caused by cars that have run accidentally into places where men were working at the face because the men had left the room switch thrown to the place in which they were working.

It should be required at all mines that room switches or switches to any place where men are working be kept alined with the straight track, except when they are being used to place cars. It would be desirable, also, to have switches blocked in the proper position with a wooden wedge or cap piece in all places from which coal is not being loaded but in which drilling, cutting, or timber crews are working.

When places in which cutting, drilling, or timber crews are working are going to the dip, it would be desirable also to have a cross tie or timber or similar definite protective material or device placed across the track of the working places.

Running Out Onto the Haulage Road Without First Determining if the Roadway is Clear

Before any type of mobile equipment is run out onto the haulage road the operator always should determine whether a motor or trip is approaching.

Riding on Haulage Locomotives

Only members of haulage crews should be permitted to ride on haulage locomotives, except in cases of emergency or by special authority of the mine foreman. Anyone riding by such authority or in case of an emergency should be required to sit in the locomotive cab and not on top of the locomotive. To make this rule effective it should apply to mine officials as well as to employees.

Many men have been severely or fatally injured by falling off locomotives while riding on top, due to a sudden lurch of the train while going around sharp turns or to derailment or coming in contact with some low place in the roof or some low timber.

The arms and legs of persons riding on locomotives always should be kept inside the cab.

In addition to the hazard of passengers falling off the locomotive when riding on top, they very often obscure the motorman's view of the entry along which they may be traveling.

Moving Cars by Hand

Pulling cars by hand is dangerous and usually not nearly as effective as pushing. If a person pulling a car should slip and fall after the car is in motion, particularly if there is a slight downgrade, in all probability the car would run over him and injure him severely.

When pushing cars by hand the fingers should not be put over the top edge of the car, whether the car is loaded or empty. A small piece of rock falling and striking the fingers might severely injure them or, if there is but little head room and the wheels should strike an obstruction or get off

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the track, the back of the car might tilt up and catch the hands between the car and the roof. If the car is loaded and should get off the track, the sudden stopping of it might cause the load to shift enough to catch the fingers.

Shaft Accidents

Although fatal and nonfatal shaft accidents are relatively few, compared to those due to underground haulage, accidents of this type are likely to have fatal results and must be given consideration and every possible precaution taken to prevent their occurrence.

The hoisting equipment at all shafts where men are handled should be of ample capacity and of a standard design recognized as safe. With the exception of small makeshift operations, coal-mine hoisting equipment is generally of this kind when installed.

Where shaft accidents have occurred because of failure of the hoisting equipment, they have been due almost always to lack of inspection and proper maintenance of the equipment rather than to inherent weaknesses.

Every hoisting engine at shafts where men are hoisted should be equipped with an overwind and overspeed device, which automatically will control the speed of the hoist and prevent overwinding should the hoisting engineer have a sudden heart attack, faint, or otherwise become incapacitated. It is desirable, also, when handling many men on a cage, slope, or trip, to have a standby hoisting man to operate the hoist in case of sudden disablement of the hoistman.

Frequent thorough inspections and tests of the hoisting engine, including the brakes and automatic protective devices, should be made to insure proper functioning.

Daily inspections of safety catches and rope attachments to the cage should be made, and each week a thorough inspection should be made of the entire rope, the entire cage, and also the sheave wheels. At these inspections, the safety catches on the cage also should be tested to make sure they are functioning properly.

Hoisting ropes should be kept lubricated properly and should be replaced when the wires on the crown are worn to 65 percent of their original diameter, or when as many as six broken wires appear in one rope lay[3].

The socket or clamp end of the rope should be cut off periodically and resocketed or reclamped in conformity with the recommendations of the manufacturers of wire ropes. The inside wires of the section of rope cut off should be inspected and, if badly worn or broken, an additional section should be cut off; if it, too, shows the same condition, the rope should be discarded.

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[3] Hood, O. P., and Kudlich, R. H., Safe Practices in Using Wire Ropes in Mines: Tech. Paper 237, Bureau of Mines, 1919, 11 pp.

Before placing new ropes in service the sheaves and hoisting drum should be examined to determine whether they have become grooved by the old ropes, and, if so, they should be turned down or replaced. New ropes of the same size will be larger in diameter than the old worn ropes, and grooves that may have been worn by the old ropes will cause the new ones to wear unnecessarily.

Where there is enough clearance between the rope clamps or socket and the sheave wheel, safety chains should extend from a special rope clamp a short distance above the regular clamp or the socket to the body of the cage. These chains should be slack so that the weight of the cage comes on them only if the regular rope attachment to the cage fails.

Every cage on which men are hoisted should be equipped with a suitable steel bonnet extending over the entire cage platform to protect the men from objects that might fall down the shaft.

Ample handholds also should be provided for the men while they stand on the cage. The cage platform should be enclosed on the sides by steel plates extending at least 5 feet above the platform, and gates should be provided at the ends of the cage platform and always used when men are transported to prevent anyone from falling against the shaft timbering or lining and being injured or killed. Where the men are hoisted at the main shaft on the same cages on which the coal is hoisted, detachable gates can be used while the men are being hoisted or lowered and removed when coal is hoisted.

Frequently, a chain is stretched across the ends of the cage platform while the men are being hoisted, but it offers little real protection to them and has failed on several occasions to prevent men who have fallen from being caught between the end of the cage platform and the shaft timbering.

Before hoisting or lowering men in shafts or slopes after the hoisting equipment has been idle for some time, the hoist should be operated sufficiently to make sure that it is safe.

Protection at Surface Landings

The shafts at all surface landings should be enclosed. The gates to the cage preferably should be of a type that may be opened only when the cage is at a landing and that will close automatically as soon as the cage has left the landing; the gate or door should be sufficiently tight and strong to prevent material or men from falling through it into the shaft.

A substantial roof should extend over the ground landing to protect the cager and those who may be waiting for a cage from falling material; similar protection should be afforded at underground landings, also.

Hoisting Signals

A definite code of signals governing the movement of the cage should be used and posted in a conspicuous place. Where a State code of signals exists, it should be used, together with such additional signals as may be found necessary, but variations from the State code should be made only when absolutely necessary.

The signals from both surface and underground landings should be given to the hoistman by some reliable and properly installed signalling device. Hand signals from the surface landings should not be permitted, even though the hoistman may have an unobstructed view of the landing. Preferably there should be at least two distinct means of signalling so that one is likely to remain in effect in case the other fails.

Safety Belts and Hats While Working in the Shaft

Workmen should be required to wear safety belts and protective hats while making repairs in or around shafts where there is danger of men falling down the shaft or being struck on the head with falling material.

Protection to Men Working in the Sump

Numerous serious and fatal injuries have occurred to men cleaning the sump at hoisting shafts when the cage has been lowered onto them accidentally. To prevent this, heavy timbers should be placed across the sump, or vertical posts resting on the bottom should be chained to the guides. To protect the men from material falling down the shaft, the cage on the side where they are working should be lowered to within a short distance of the bottom.

At some mines the hoistman is required to hang a notice on the throttle to the effect that men are working in the sump and must not remove the notice or move the cage until notified by telephone from the bottom that the men are out of the sump. This plan serves to remind the hoistman on duty and avoids the possibility of one hoistman failing to notify the other of the fact that men are in the sump should there be a change of shifts before the work in the sump is completed.

Waiting Near Shaft Bottom

At mines where men are hoisted at the main shaft and where the coal is loaded by hand on a tonnage basis, it is often the practice for some of the men to come to the shaft bottom while coal is still being hoisted and thus to be exposed to the hazard of moving cars as well as to possible injury from coal or other material that may fall in the shaft and bounce out into the shaft station. To avoid this hazard, a waiting place convenient to the shaft bottom should be provided, where the men can wait until the end of the hoisting shift.

Protection of Bottom Cagers From Falling Coal

At most coal mines where the cars are hoisted on self-dumping cages and where the hoisting is rapid, considerable coal falls off the cars as they are dumped; and unless the bottom cagers are given some protection, they are

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apt to be struck by flying pieces of coal. This protection may be accomplished largely by hanging old shaker-screen plates from the doorhead timbers on the side from which the cars are caged. These plates should extend down low enough just to clear the loaded cars, and should also be hinged at the top to permit them to swing out of the way while rails or other long material are lowered.

Runaround or Passageway at the Bottom of Hoisting Shaft

The law in most coal-mining States requires that a runaround or passageway be maintained at the bottom of the hoisting shaft to enable employees to go from one side of the shaft to the other without crossing over on the cage. This requirement was the result of numerous accidents from operation of the cage while men were attempting to cross it. The runaround should offer safe and unobstructed passage from one side of the shaft to the other. It should be well-lighted and at no time should be blocked by cars or other equipment or used as a storage place for supplies or material.

Illumination of Cage Landings

All cage landings should be well-lighted, particularly surface landings at upcast shafts where the warm moist air coming up the shaft forms a fog in the winter when it strikes the cold outside air. Where this latter condition prevails, possibly amber floodlights similar to the fog lights used on automobiles would be suitable.

CONCLUSION

Accidents from coal-mine haulage as well as from other causes can be reduced to a minimum as compared with present occurrences. To do this, however, the operator must be keenly interested in accident reduction and must be willing to take the initiative by removing all physical hazards within his power and then, through precept and example on the part of the supervisory force, eliminate the many unsafe haulage practices that in the past have been responsible for such a large percentage of haulage accidents. Mine haulage accidents are analogous in their numerous perplexing problems to accidents from automotive and other mobile equipment on the surface; however, the mine-haulage accident problem should be solved much more readily than that on the surface, because mines have far better opportunities to control the conditions that enter into haulage accidents than our city, State, and national authorities have over the multitudinous conditions affecting surface accidents due to mobile equipment.